

**IBM Technical Brief** 

## SAP® HANA® DB Migration from x86 to POWER® via HANA System Replication

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**IBM POWER and SAP Solutions** 

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## 1. Disclaimers

This paper demonstrates a way to migrate a HANA® database from x86 HANA 2.0 SPS02 to POWER HANA 2.0 SPS02 using HANA System Replication while minimizing the impact on end users. It is not a best practices guide. This process has been tested on our lab systems in the configuration described.

## 2. Trademarks

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## 3. Version Changes

Version 1.0: February 28, 2018 - initial version

## 4. Acknowledgements

Thank you to Lou Lamprinakos, Damir Rubic and Andrew Castillo for reading the draft and offering suggestions for improvements.

## 5. Feedback

Please send comments or suggestions for changes to gordonmr@us.ibm.com.



## 6. Introduction

This paper demonstrates a process to migrate a scale-up HANA 2.0 DB on Intel to a HANA DB on IBM POWER using HANA System Replication. *The only end-user impact is a few minutes suspension of the SAP system when the takeover to HANA DB on IBM POWER is executed.* 

HANA system replication can be used to migrate between X86 and POWER when the source DB is HANA 2.0, and the target DB is at an equal or later version of HANA.

HANA 2.0 on POWER runs on the Little-Endian (LE) SLES12 Operating System as well as on Red Hat RHEL for SAP HANA 7 (LE). HANA on X86 is also LE. *As described in SAP note 1999880 item 14, replication can be done between different types of hardware, as long as they are both LE.* In this demonstration, the source DB is on SLES 12 on X86 and the target is SLES 12 on POWER.

When using HANA System Replication, the primary and secondary (i.e. source and target) DBs must have similar topology - both must also have the same number of index servers.

SAP note 1984882 outlines how to use HANA system replication to change hardware platforms. The process is executed with more detail in this paper.

SAP note 2364819 describes a process to quiesce the application server work processes, so that one can do a near-zero downtime cutover from x86 HANA to POWER HANA. Do not use the quiesce process in SAP note 1913302, it has been superseded by 2364819.

We will apply SAP note 2381360, which supplies the program SUSPEND\_HDB\_CONNECTION used in SAP note 2364819. This program is used to suspend the application server work processes and disconnect them from the HANA database.

# 7. DB Migration Steps

Our source system is a single-node X86 (under VMware) HANA DB. It is not currently configured with HANA System Replication. It contains the HN1 tenant, which is a Netweaver 7.5 DB.

SYSTEMDB@HN1 (SYSTEM) atssg139.svl.ibm.com 00									
Overview Landscape Alerts Performance Volum	nes Configuration System Information Diagnosis Files Trace Configuration								
General Information									
Operational Status:	All services started								
Start Time of First Started Service:	Feb 8, 2018 6:00:53 PM								
Start Time of Most Recently Started Service:	Feb 8, 2018 6:02:34 PM								
Distributed System:	No								
Version:	2.00.020.00.1500920972 (fa/hana2sp02)								
Build Time:	Jul 24, 2017 8:35:12 PM								
Platform:	SUSE Linux Enterprise Server 12.2								
Linux Kernel Version:	4.4.21-69-default								
Hardware Manufacturer:	VMware, Inc.								

Figure 1: Current X86 productive HANA DB



Our goal is to migrate the contents of the X86 HANA DB to this POWER HANA DB system. This DB is a newly installed HANA DB.

verview Landscape Alerts Performance Volum	nes Configuration System Information Diagnosis Files Trace Configuration
General Information	
Operational Status:	All services started
System Usage:	Custom System
Start Time of First Started Service:	Feb 8, 2018 5:58:57 PM
Start Time of Most Recently Started Service:	Feb 8, 2018 6:00:04 PM
Distributed System:	No
Version:	2.00.020.00.1500920972 (fa/hana2sp02)
Build Time:	Jul 24, 2017 8:43:16 PM
Platform:	SUSE Linux Enterprise Server 12.2
Linux Kernel Version:	4.4.103-92.56-default
Hardware Manufacturer:	IBM

Figure 2: To-be productive POWER HANA DB

Check SAP note 1999880 item 15. The secondary must be at the same or higher patch level. In our case, both systems are the same version.

### 7.1. Pre-requisites

Verify support for the SAP application on HANA on POWER DB in the SAP PAM and SAP notes 2218464 and 2420699. Review OS support for HANA in SAP note 2235581.

### 7.2. Preparation

Apply SAP note 2381360 and transport it through the landscape to the Netweaver system that is being migrated.



### Figure 3: SNOTE

On the Netweaver SAP system, set SAP dbs/hdb/quiesce\_all\_connections parameters as described in SAP note 2364819. Also, rdisp/wpmax\_run\_time must be set to a value high enough to complete all the cutover activities in Section 7.4. We placed both in DEFAULT.PFL.

```
dbs/hdb/quiesce_all_connections = 1
rdisp/max_wprun_time = 600
atcon120.bodadm_5(>_____
```

Figure 4: Set SAP parameters for cutover

### 7.3. Configure System Replication

Our starting point is that host atssg139 is a running database for Netweaver 7.5, and host atssg86 is a newly installed HANA DB.

Per SAP note 2369981, we copy "key" and "dat" files to the secondary (POWER DB) system.

[atssg86:/usr/sap/HN1/SYS/global/security/rsecssfs/key # scp atssg139:/usr/sap/HN1/SYS/global/security/rsecssfs/key/SSFS\_HN1.KEY .
[Password:
SSFS\_HN1.KEY

#### Figure 5: Copy KEY

[atssg86:/usr/sap/HN1/SYS/global/security/rsecssfs/data # scp atssg139:/usr/sap/HN1/SYS/global/security/rsecssfs/data/SSFS\_HN1.DAT .
[Password:
SSFS\_HN1.DAT

#### Figure 6: Copy DAT

Enable the X86 DB system atssg139 as the primary (source) replication DB.

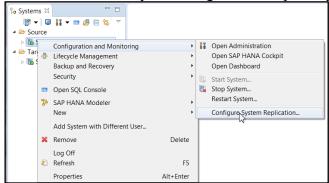


Figure 7: Configure replication on primary

### Specify this will be the primary.



**Figure 8: Set Primary** 



For replication, each system has a unique logical name. We will use "ASIDE" on atssg139 (x86) and "BSIDE" on atssg86 (POWER).

Configure System Replication for	or System HN1
Enable system replication on the system	em.
Primary System Logical Name: <sup>®</sup> ASIE	ле
Primary System Information (HN1): Host: atssg139.svl.ibm.o Instance Number: 00	com
🛎 Last Data Backup:	2018-02-08 00:01:51
0	< <u>Back Next</u> > <u>Finish</u> Cancel

**Figure 9: Parameters for Primary** 

After this executes, atssg139 is enabled to act as primary, but it has no secondary system attached to it.

Configure atssg86 as a secondary system. All the data in atssg139 will be replicated to atssg86. Shut down HANA on the to-be secondary before configuring replication.

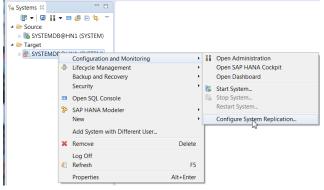


Figure 10: Configure replication on secondary

Configure System Replication for System HN1 Select the configuration action you want to perform.	
Actions:	- 1
<ul> <li>Enable system replication</li> <li>Action not possible. The system must be running before system replication can be enabled.</li> </ul>	
Register secondary system Register the system as the secondary system of the primary system or tier 2 secondary system (source system).	Ξ
<ul> <li>Unregister Secondary System</li> <li>Action not possible. The system is not registered as a secondary system of a source system.</li> </ul>	
<ul> <li>Perform takeover</li> <li>Action not possible. System replication is not configured.</li> </ul>	
? < Back Next > Finish Cance	el

Figure 11: Register secondary



#### Enter parameters for registration.

Configure System Replication for System HN1									
Register the system a (source system).	as the seconda	ry system of the primary system or tier 2 secondary system							
Secondary System Lo	gical Name: <sup>8</sup>		^						
Replication Mode:		Synchronous in memory (mode=syncmem)							
Operation Mode:		logreplay 🔻	=						
	atssg139 00 shipping								
0		< Back Next > Finish Cancel	-						

Figure 12: Secondary registration parameters

Wait for replication to be complete. The larger the database, the longer this will take.

5.510	insperint (Sisit	M) atssg139.svl.ibm.com	100			Las	t Upda
verview La	ndscape Alerts Performa	nce Volumes Configuratio	n System Information Di	agnosis Files	Trace Configuration		
ervices Ho	sts System Replication						
Enter your	filter 🚯 Visible ro	ws: 3/3					
		,					
	filter      Wisible ro      SECONDARY_HOST	ws: 3/3 REPLICATION_MODE	REPLICATION_STAT	US AB REP	LICATION_STATUS_DETAILS	12	PORT
Enter your HOST atssg139	R8 SECONDARY_HOST	,	REPLICATION_STAT	US AB REP	LICATION_STATUS_DETAILS	12	PORT 30,007
HOST	RESIDENT Atssg86	REPLICATION_MODE			LICATION_STATUS_DETAILS ica: 72 % (6016/8352 MB)	12	

Figure 13: Waiting for replication to be caught up

### Replication is complete.

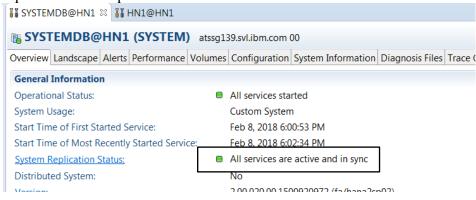


Figure 14: Replication active and in sync

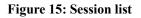
### 7.4. Cutover to use POWER DB as productive system

Each SAP work process has at least one connection to the HANA DB. We will use the method in SAP note 2364819, and the program SUSPEND\_HDB\_CONNECTION to stop the processes during upgrade. Note that SUSPEND\_HDB\_CONNECTION suspends work process as they finish a dialog step. Long running batch jobs should *not* be scheduled to run at the time of the cutover to POWER HANA.

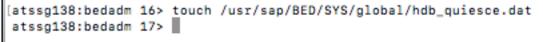


Using the SAP schema userid (SAPABAP1 on our test system), show the session list. The "ABAP:BED" Applications are SAP work process connections.

HN1@HN1	1 🛙						
16 HN1@	HN1 (SAPAB	AP1) atssg139.svl.ibm.	com 00				Last Update: Fe
Overview Lar	ndscape Alerts Pe	erformance Volumes Con	figuration System Informa	ation Diagnosis Files T	race Configuration		
Threads Ses	sions Blocked Tra	nsactions SQL Plan Cache	Expensive Statements Tra	ace Job Progress			
• Summar	У						
Entervourt	filtor (1) Vi	sible roug 21/21					
Enter your t		sible rows: 21/21					
<sup>2</sup> Blocks		Application Source	Application Version	Application User	RB Database User	R Client Host	AB Client IP
0	ABAP:BED	?	749 PL 200	bedadm	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	SAPMSSY2:841	749 PL 200		SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	?	749 PL 200	bedadm	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	?	749 PL 200	bedadm	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	SAPLSBAL_DB_INTERN	749 PL 200		SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	?	749 PL 200	bedadm	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	SAPMSSY2:841	749 PL 200	SAPSYS	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	SAPLSAML2_CACHE:207	749 PL 200	SAPSYS	SAPABAP1	atssg138	9.30.175.138
0	ABAP:BED	?	749 PL 200	bedadm	SAPABAP1	atssg138	9.30.175.138
	4040050	CAD140000 444	740 01 200		CAD40404		0.00.175.100



On the application server, create the file /usr/sap/<SID>/SYS/global/hdb\_quiesce.dat. When the dbs/hdb/quiesce\_check\_enable parameter is set by SUSPEND\_HDB\_CONNECTION in the next step, the work processes will be stopped.



#### Figure 16: touch hdb\_quiesce.dat

On the Netweaver system, execute SUSPEND\_HDB\_CONNECTION.

Program B	Edit G	oto U	tilities	Environ	ment	System	Help		
0			~		0	8	H	4 2 2 2	1
ABAP E	ditor	Init	ial S	creen	1				
1 🔑	Ð	÷		<u>i</u>	Ŵ		A_B	🕁 Debugging	(
Program Subobjects	[ຣບ	SPEND_	HDB_C	ONNECTI	ON	<u>]</u> ব		Create	
• Source Co	de								

Figure 17: SUSPEND\_HDB\_CONNECTION



Set the parameters to suspend all work processes on all app servers.

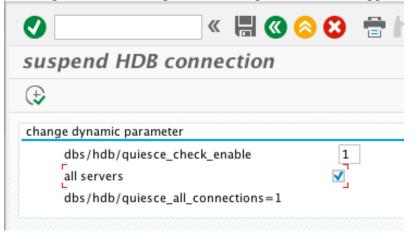


Figure 18: SUSPEND\_HDB\_CONNECTION parameters

When the program is executed, it hangs – all the work processes are suspended! We will need to check in HANA if there are other ABAP sessions.

	8 🖫

Figure 19: SUSPEND\_HDB\_CONNECTIONS hangs

### Check using the session list in HANA. Note that all the "ABAP:BED" Applications are gone.

-		) atssg139.svl.ibm.com 00 nance Volumes Configuration	Last Update: Fe	eb 8, 2018 12:23:58	8 PM 💞   🕪 1	Interval: 60 🔻	Sec				
		ions SQL Plan Cache Expens									
· · · · · · · · · · · · · · · · · · ·					-						
Summary											
Summary Enter your filter	Visible	rows: 2/2						Hide Se	essions 🔻 💈	🌣 Filters 🔻 🔚	Save
	<ul> <li>Visible</li> <li>Server Port</li> </ul>	rows: 2/2 12 Logical Connection ID	Created At	12 S	RE Connection status	RB Transaction status	AB Auto commit	Hide Se Blocked b	essions ▼ ‡ 12 Blocks	Filters ▼ III : Application	
Enter your filter		12 Logical Connection ID	Created At Feb 8, 2018 8:23:4		R Connection status	R Transaction status	R Auto commit				



We are now ready to make the POWER DB the productive database.



A virtual IP address, atssg137, is used by the application servers to identify the HANA DB.

```
[atssg138:bedadm 44> hdbuserstore LIST
DATA FILE : /home/bedadm/.hdb/atssg138/SSFS_HDB.DAT
KEY FILE : /home/bedadm/.hdb/atssg138/SSFS_HDB.KEY
KEY DEFAULT
ENV : atssg137.svl.ibm.com:30015
USER: SAPABAP1
```

Figure 21: hdbuserstore LIST on application server

Display network interfaces on atssg139, the X86 HANA DB. Note that atssg137 is a virtual IP address defined on adapter eth0.

<pre>atssg139:~ # netstat -i</pre>						
Kernel Interface table						
Iface MTU Met RX-OK RX-	ERR RX-DRP RX-0	VR TX-	OK TX-ERR TX	-DRP TX-OV	R Flg	
eth0 1500 0 303	0382 0	0	0 8557370	Θ	0 0	BMRU
eth0:atssg137 1500 0	- no statistics	availabl	.e -		BMRU	
lo 65536 0 597	75827 0	0	0 5975827	Θ	0 0	LRU
atssg139:~ #						

Figure 22: atssg139 netstat before remove VIPA

In the SUSE administration tool, YaST, delete the VIPA from atssg139.

	YaST2 - Net	work Settings	-		×
Network Card Setu	Р				
General	Address	Hard <u>w</u> are			
Device Type Ethernet	Cenfig eth0	ration Name			
<ul> <li>No Link and IP Setup (Bo</li> </ul>		/alues			
O Dynamic Address	CP 🚽 DHCP t	both version 4 and 6 🔫			
• Statically Assigned IP Add	dress				
IP Address	Subnet Mask	H <u>o</u> stname			
9.30.175.139	/24	atssg139			
Additional Addresses					
IPv4 Address Label	<ul> <li>IP Address Netmask</li> </ul>				
atssg137	9.30.175.137 255.255.	255.0			
Ad <u>d</u> <u>E</u> dit	Delete				
Help		<u>C</u> ancel	Back	Next	

Figure 23: Delete VIPA on atssg139

Using command line on atssg139, verify VIPA atssg137 is gone. Once the VIPA is gone, it is not possible for the SAP work processes to connect to atssg137, until we re-create the VIPA after takeover.

atssgl	L39:~ ‡	net:	stat -i								
Kernel	l Inte	rface	table								
Iface	MTU	Met	RX-0K	RX - ERR	RX-DRP	RX-0VR	TX-0K	TX-ERR	TX-DRP	TX-0VR	Flg
eth0	1500	0	3092768	0	0	0	8650033	0	0	0	BMRU
			6143206	0	0	0	6143206	0	0	0	LRU
atssol	39:~ #	#									

Figure 24: atssg139 after delete VIPA



### On the current secondary system (atssg86 POWER HANA), perform HANA takeover.

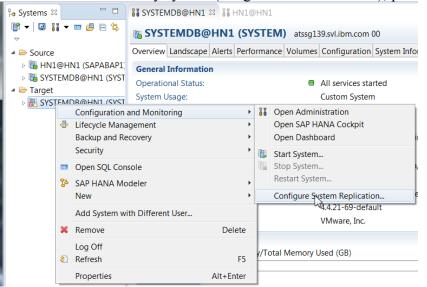


Figure 25: Start takeover on secondary

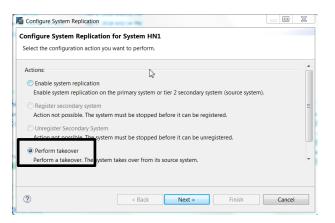


Figure 26: Perform takeover

Configure System	Replication	
Configure System	n Replication for System HN1	
Perform a takeover performed on the s	The secondary system takes over from its source system. No actions a ource system.	re
Secondary System	Information (HN1)	-
Host:	atssg86.svl.ibm.com	=
Instance Number:	00	
		*
?	< Back Next > Finish	Cancel

Figure 27: Takeover information



At this point, atssg139 (the former primary) is still running, but no SAP processes are connected. Also, atssg86 (the new productive DB) is up and ready to accept connections from the application server. But since the VIPA has been deleted and the work processes stopped, there are no connections to the atssg86 DB.

🎙 o Systems 🛛 🗖 🗖	II SYSTEMDB@HN1 ⋈	
♥ ▼   ■ 11 ▼ = 2 = 5	SYSTEMDB@HN1 (SYSTEM) atss	g86.svl.ibm.com 00
🔺 🗁 Source	Overview Landscape Alerts Performance Volum	nes Configuration System Information Diagnosis Files Trace Confi
» 職 HN1@HN1 (SAPABAP1)	General Information	
» 🔀 SYSTEMDB@HN1 (SYST + 🕞 Terret	Operational Status:	All services started
Target File SYSTEMDB@HN1 (SYST)	System Usage:	Custom System
	Start Time of First Started Service:	Feb 8, 2018 6:00:53 PM
	Start Time of Most Recently Started Service:	Feb 8, 2018 6:59:47 PM
	Distributed System:	No
	Version:	2.00.020.00.1500920972 (fa/hana2sp02)
	Build Time:	Jul 24, 2017 8:43:16 PM
	Platform:	SUSE Linux Enterprise Server 12.2
	Linux Kernel Version:	4.4.103-92.56-default
	Hardware Manufacturer:	IBM
	SAP HANA Used Memory	

Shutdown the X86 DB server, to make sure no work processes can connect to the wrong system.

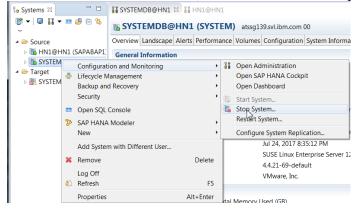


Figure 28: Shutdown HANA on atssg139

op Syste	m HN1	
top all dat	abases of system HN1 based on the specified parameters	
Shutdown	Туре	
Soft		
	the system. Running statements finish executing. After the sp	pecified timeout, the system is hard stopped.
Date:	2/ 9/2018	
Time:	9:42:08 AM	G
Hard		
Stops	the system immediately. Open transactions are aborted and	rolled back.
?)		OK Cancel

Figure 29: Stop System on atssg139

Once it is stopped, we go on to the next step.



Using SUSE YaST, define VIPA atssg137 on atssg86, so that the SAP work processes will be able to connect to the new DB server.

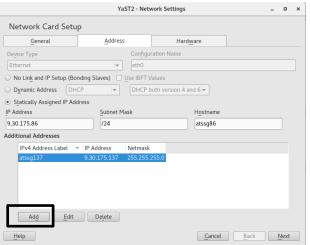


Figure 30: Add VIPA to POWER DB server

Verify atssg137 VIPA is now on atssg86.

atssg86:~ # net	stat -i									
Kernel Interfac	e table									
Iface MTU Met	RX-0K	RX-ERR F	X-DRP RX-0	/R	TX-0K	TX-ERR '	TX-DRP TX-OV	/R Fl	g	
eth0	1500 0	8298968	Θ	0	0	2306137	Θ	0	0	BMRU
eth0:atssg137	1500 0	- no	statistics	ava	ilable -				BMRU	
lo 6	5536 0	4357048	Θ	0	0	4357048	Θ	0	0	LRU
atssg86:~ #										

Figure 31: Confirm VIPA is on atssg86

Remove the file to enable work processes to restart [atssg138:bedadm 51> rm /usr/sap/BED/SYS/global/hdb\_quiesce.dat

```
The SUSPEND_HDB_CONNECTIONS program now finishes running
```

suspend HDB connection	
suspend HDB connection	
<pre>set dbs/hdb/quiesce_check_enable = 1</pre>	
application server = atssg138_BED_00	: done
reconnect done	

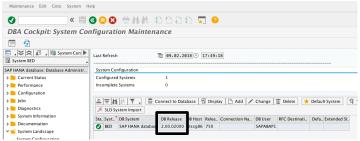


On the new productive DB, atssg86, show sessions for SAPABAP1. Note that the application server work processes ("ABAP:BED" Applications)have all reconnected.

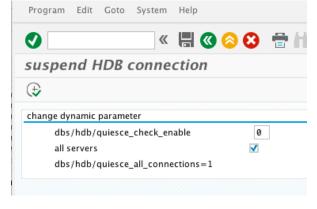
	· · · ·									
SYSTEMDB@HN	1 👬 HN1@HN	1 22								
HN1@HN1	(SAPABAP1)	atssg86.svl.ibm.com 00					Last Update	: Feb 9, 2018 9:47:38 AM 🦑 🛙 💷	Inter	rval: 60 🔻 Sec
verview Landsca	e Alerts Performa	ance Volumes Configuration	on System Inform	nation Dia	ignosis Files Trace Conf	iguration				
Threads Sessions	Blocked Transactic	ons SQL Plan Cache Expen	sive Statements T	race Job	Progress					
Summary										
Enter your filter	Visible re	ows: 22/22						Hide Sessions 💌	\$≱ Fi	
<ul> <li>Server Host</li> </ul>	12 Server Port	Logical Connection ID	Created At	12 Se	Connection status	·* Transaction status	Auto commit	· Blocked by Connection ID	12	Application
atssg86	30,003	300,165	Feb 9, 2018 5:	742	IDLE	ACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
atssg86	30,003	300,168	Feb 9, 2018 5:	742	IDLE	ACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
atssg86	30,003	300,173	Feb 9, 2018 5:	742	IDLE	ACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
atssg86	30,003	300,174	Feb 9, 2018 5:	742	IDLE	ACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
atssg86	30,003	300,179	Feb 9, 2018 5:	79	IDLE	INACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
atssg86	30,003	300,180	Feb 9, 2018 5:	742	IDLE	ACTIVE	FALSE	<not blocked=""></not>	N	ABAP:BED
atssg86	30,003	300,182	Feb 9, 2018 5:	19	IDLE	ACTIVE	FALSE	<not blocked=""></not>	3	ABAP:BED
atssg86	30,003	300,185	Feb 9, 2018 5:	379	IDLE	ACTIVE	FALSE	<not blocked=""></not>		ABAP:BED
	20.000	200.405	5 1 0 0010 F	4.04	101.5	1.070.05	51105			

Figure 32: Session list on atssg86

We can now run transactions on the SAP application servers. DBACOCKPIT shows SAP is now connected to atssg86, the POWER DB server. We have successfully executed the migration from X86 HANA to POWER HANA.



Run SUSPEND HDB CONNECTION and set dbs/hdb/quiesce check enable back to original value of 0.



And at the next service window, remove "dbs/hdb/quiesce all connections" from the SAP parameter files.